

Silurian Rhynchonellide Brachiopods from Yass, New South Wales

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Rhynchonellide brachiopods are rare in the Silurian sequence at Yass. In this paper two species are described, one new species *Agarhynchus australe* being abundant at just one locality in the late Wenlock or earliest Ludlow Yass Formation. The other species, tentatively assigned to *Tuvaerhynchus*, is known from only a few specimens of late Wenlock to Ludfordian age.

Manuscript received 19 October 2008, accepted for publication 21 January 2009.

KEYWORDS: *Agarhyncha australe*, Ludlow, rhynchonellide, Silurian, *Tuvaerhynchus*, Wenlock, Yass

INTRODUCTION

Rhynchonellide brachiopods were recognised in early accounts of the stratigraphy of the Yass Syncline, but none has ever been described. Jenkins (1879, p. 26) recorded *Rhynchonella* from what (using modern terminology) was probably the basal Bowspring Limestone at locality GOU57, and Mitchell (1887, p. 1201) listed the same genus from pebbles in the Sharpeningstone Conglomerate at Bowning (two specimens, described in this paper). Shearsby (1912, pp. 110-112) in his more detailed account of the succession north of Yass then noted the presence of possible *Rhynchotreta* and *Camarotoechia* at two localities, one within the Douro Volcanics, the other in the Yass Formation. The latter is in the same area along Derringullen Creek from which both of the species described in this paper were collected by Dr R.S. Nicoll and myself in 1982. However, other than at that locality, rhynchonellides are rare (only six usable specimens) in the Yass sequence.

Only two taxa can be recognised. The first, *Agarhyncha australe* n. sp., occurs at only the one locality (on Derringullen Creek), just below the Cliftonwood Limestone Member of the Yass Formation, but is there in some numbers. *Agarhyncha* Havlíček, 1982, is otherwise known from the Wenlock and Ludlow of the Czech Republic. The other Yass rhynchonellide occurs in very low numbers at a few localities from the Yass Formation to the Yarwood

Siltstone Member of the Black Bog Shale, and in pebbles in the Sharpeningstone Conglomerate. It is tentatively referred to the genus *Tuvaerhynchus* Kul'kov, 1985, from the Wenlock of Tuva. This raises some problems concerning provinciality which cannot be properly assessed until better material from Yass becomes available, enabling more confident identification.

For a diagrammatic representation of Yass stratigraphy and ages, refer to Strusz (2002, fig. 1). Localities are detailed in that publication, with additions in Strusz (2003, 2005).

SYSTEMATIC PALAEOLOGY

Classification

The classification followed is that of Savage et al. (2002).

Measurements and symbols

All linear measurements are in millimetres, and unless otherwise specified are as defined by Williams and Brunton (1997); the following symbols are used for these measurements:

Ls, Ws, Ts – maximum shell length, width, thickness.

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L(Wmax) – length to widest part of shell.

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SILURIAN BRACHIOPODS FROM YASS

Repositories

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AMF - macrofossil collection, Australian Museum, Sydney.

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Phylum BRACHIOPODA

Class RHYNCHONELLATA Williams, Carlson, Brunton, Holmer and Popov, 1996

Order RHYNCHONELLIDA Kuhn, 1949

Superfamily RHYNCHOTREMATOIDEA Schuchert, 1913

Family TRIGONIRHYNCHIIDAE Schmidt, 1965

Subfamily TRIGONIRHYNCHIIDAE Schmidt, 1965

Genus *Agarhyncha* Havlíček, 1982

Type species

Terebratulafamula Barrande, 1847, by original designation; Ludlow, Bohemia.

Diagnosis

Subpentagonal to subcircular outline; biconvex to globose profile. Beak suberect to erect; foramen with minute deltidial plates. Fold and sulcus well defined, broad, anterior commissure uniplicate; tongue rectangular, serrate. Costae coarse, rounded, simple, but umbones smooth. Dental plates very short. Dorsal median septum thin; septalium with cover plate anteriorly; crura close to septum posteriorly (Savage p. 1052 in Savage et al. 2002).

Agarhyncha australe sp. nov.

Figs 1-5, Table 1

Diagnosis

Relatively large biconvex species of *Agarhyncha* with smooth non-sulcate umbones, sulcus often weak anteriorly, ribs only moderately developed, medially concave dental plates, impressed ventral muscle field, raduliform crura, long dorsal median septum.

Material

Holotype CPC39529, paratypes CPC39530-39592, all from locality GOU49.

Horizon

Topmost O'Briens Creek Member, Yass Formation.

Age

Probably Homeric (late Wenlock), possibly earliest Gorstian (early Ludlow).

Description

Juvenile shells (taken as $Ws \leq 6.0$ mm - see Fig. 4b) lenticular, biconvex to ventribiconvex, elongate lacrimiform to lozenge-shaped (mean juvenile Ls/Ws 1.10, mostly 1.0-1.2), generally relatively thin (mean juvenile Ts/Ws 0.43, mostly 0.35-0.50). Adult shells ($Ws > 6$ mm) subtriangular to subpentagonal, biconvex to slightly ventribiconvex, largest shells globose (mean adult Ts/Ws 0.55, max. 0.85). Maximum observed width 12.2 mm; length about equal to width (mean adult Ls/Ws 1.01, mostly 0.9 - 1.1). Dorsal fold and ventral sulcus appear at lengths of 3-4 mm, generally shallow, but variably developed anteriorly in larger shells; tongue when developed trapezoidal. Ventral beak suberect, sharp (especially in juveniles), usually small but in some shells extended posteriorly. Foramen mesothyrid (Fig. 1h), delthyrium wide, deltidial plates narrow, disjunct. Umbones smooth, ribs appearing at Ls from 2.5 to 5 mm, initially faint. Ribs anteriorly rounded-angular, simple, generally low (especially laterally); margins of sulcus defined by pair of relatively well developed ribs, sulcus contains 1-3 ribs (2-4 on fold); 2-5 ribs on each flank.

Shell generally thin-walled. Dental plates short, upright to gently convergent ventrally, somewhat concave medially. Ventral muscle field elongate, moderately impressed into slightly medially thickened shell, may be divided by very low myophragm. Dorsal median septum long (at least $Ls/2$), posteriorly supports small V-shaped septalium (Fig. 3) which is open posteriorly, covered mid-length to anteriorly (see Fig. 2, especially CPC39544, sections 1.2 to 1.8 mm). Outer hinge plates wide, flat in narrow zones between crural bases and inner socket ridges, moderately thick medially and generally strongly thickened beneath sockets. Sockets widely divergent, large; inner socket ridges robust, outer socket ridges merged with valve walls. Crural bases strong, triangular; crura calciform, curved somewhat towards ventral valve. No cardinal process.

Remarks

This form differs from leiorhynchids in its generally thin-walled shell which is mostly not globose, in its only moderately impressed ventral

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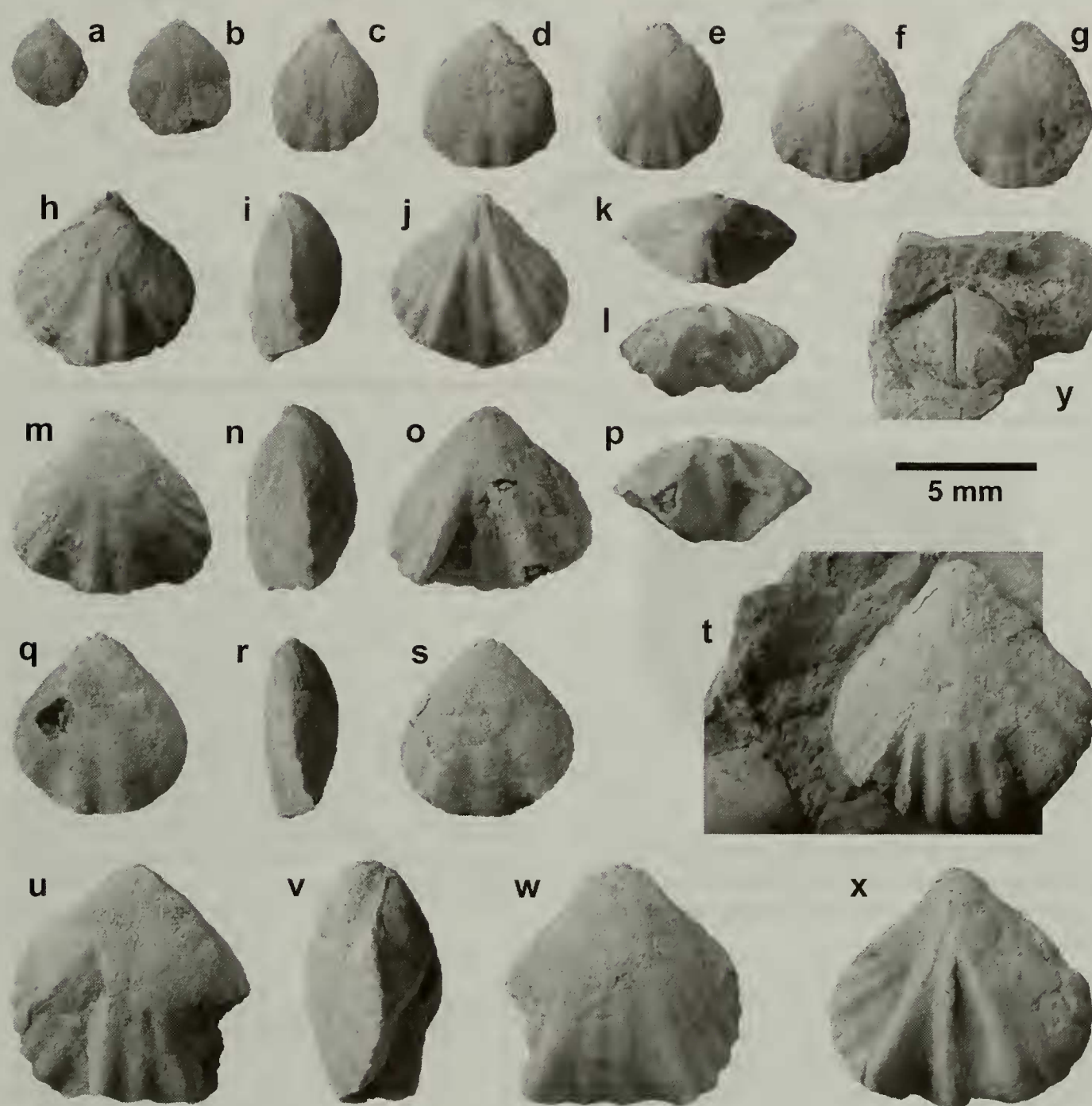


Figure 1. *Agarhyncha australe*; a-g, growth series of paratype shells in dorsal aspect, CPC39535, 39536, 39537, 39540, 39539, 39541, 39538; h-l, holotype CPC39529 in dorsal, lateral, ventral, posterior and anterior aspects; m-p, paratype CPC39532 in dorsal, lateral, ventral and anterior aspects, a partly decorticated relatively wide shell with anteriorly well developed fold; q-s, paratype CPC39533 in dorsal, lateral and ventral aspects, a posteriorly decorticated shell with low convexity, few subdued ribs; t, paratype CPC39543, a large shell in ventral aspect, with 4 anteriorly strong ribs in sulcus; u-w, paratype CPC 39534 in dorsal, lateral and ventral aspects, a posteriorly decorticated large shell showing local crushing, presumably before lithification of the enclosing sediment; x, paratype CPC 39542, a large relatively wide shell in ventral aspect; y, paratype CPC39592, a dorsal internal mould (see Fig. 3). All x4, scale bar 5 mm. Locality GOU49, Yass Formation, O'Briens Creek Member immediately below Cliftonwood Limestone; probably Late Wenlock.

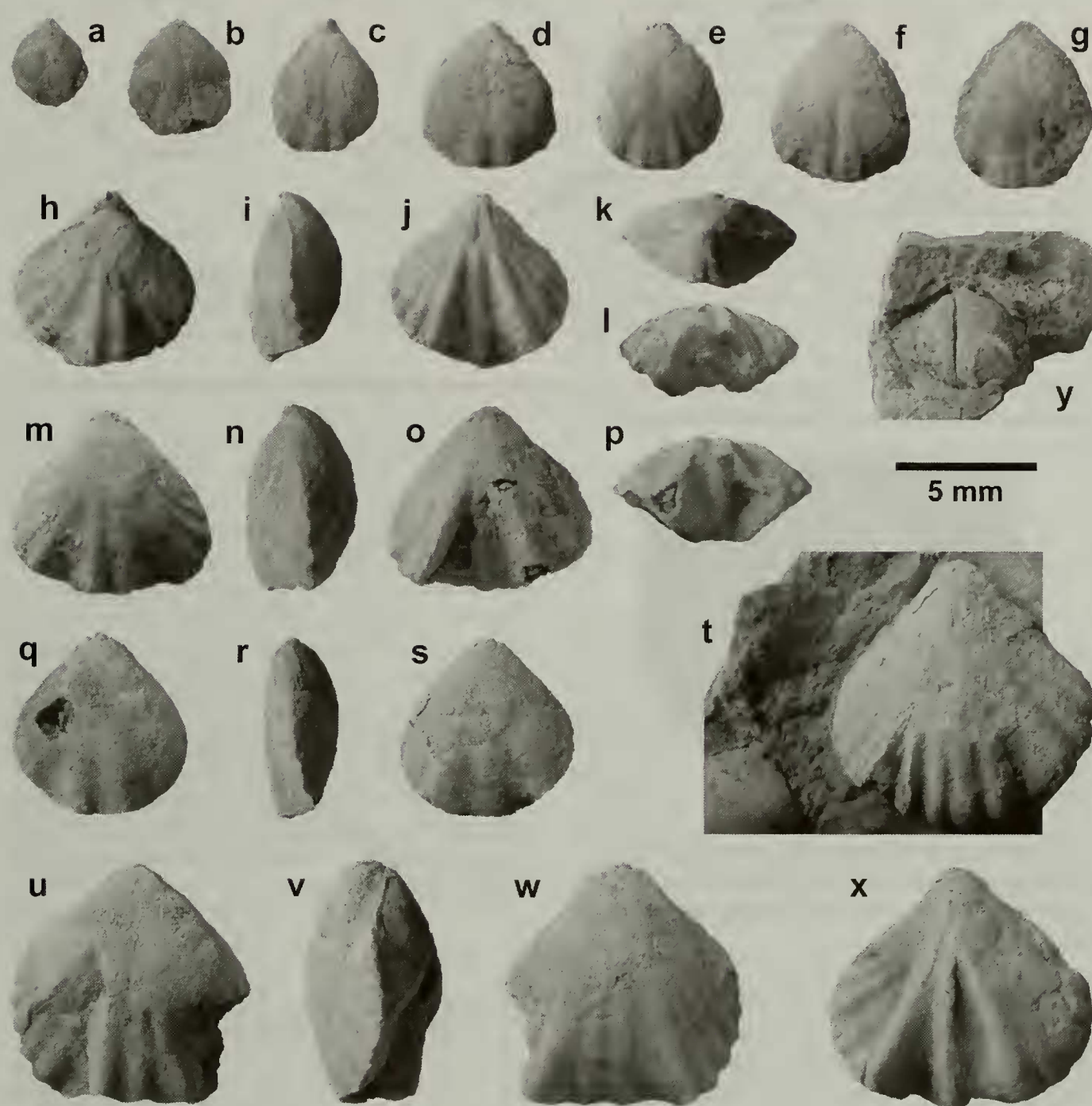


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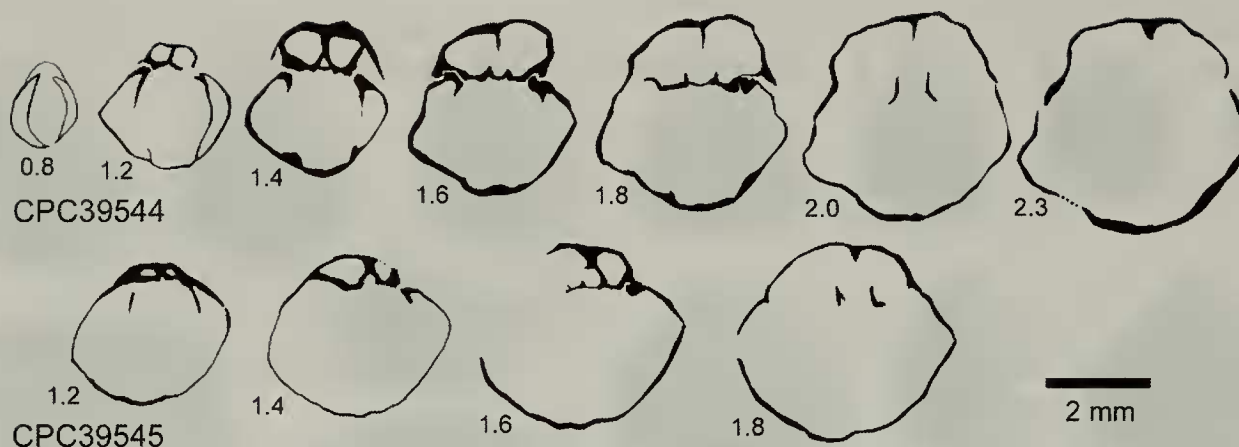


Figure 2. *Agarhyncha australe*; selected serial sections of paratypes CPC39544, 39545; distances from posterior ends in millimetres. Scale bar 2 mm.

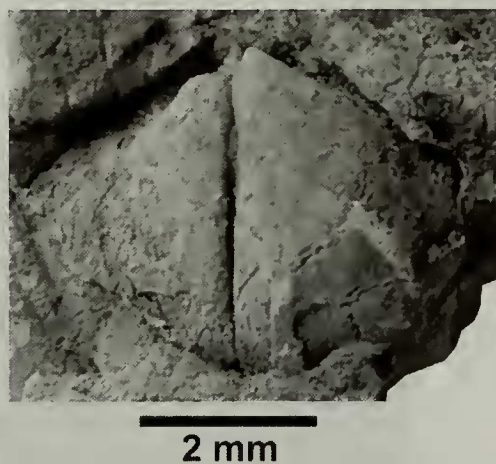


Figure 3. *Agarhyncha australe*; paratype dorsal internal mould CPC39592 enlarged to show septalium and long but low median septum. Scale bar 2 mm.

muscle field, and a cover plate on the septalium. From rhynchotrematids it differs in its smooth umbones, distinct dental plates and lack of a cardinal process. It shares important features with the Trigonirhynchiidae. Among trigonirhynchiids *Astua* Havlíček, 1992 (Lochkovian, Bohemia and central Asia) differs in stronger ribs, fold and sulcus, an emarginate anterior commissure, and internally in lacking a cover-plate on the septalium. *Oxypleurorhynchia* Plodowski, 1973 (Přídolí, Carnic Alps) is dorsibiconvex, with coarse ribs and pronounced fold and sulcus extending from the umbones. *Virginata* Amsden, 1968 (Llandovery to Ludlow, N. America, China and Siberia) lacks fold and sulcus, but its ribs extend from the beaks; it also differs in being more elongate, having a posterior cover-plate on the very small septalium, robust cardinalia, and a short dorsal median septum. The new species is referred to the Bohemian Wenlock to Ludlow genus *Agarhyncha* on the basis of its

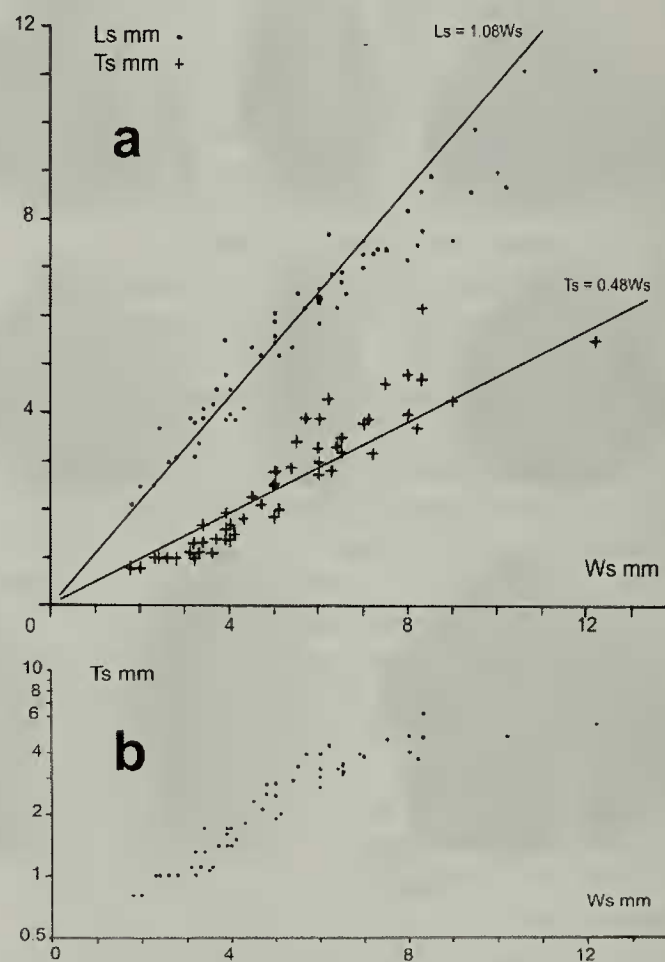


Figure 4. *Agarhyncha australe*; a, length (Ls) and thickness (Ts) plotted against width (Ws). The divergence from the overall means at widths above 6 mm is just noticeable on these plots; b, thickness (Ts) plotted against width (Ws) on log-normal coordinates; in this plot the change in growth parameters at a width of about 6 mm is quite clear.

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The Ludlow-age type species, *Agarhyncha famula* (Barrande, 1847) is smaller (Ws to c. 9.6

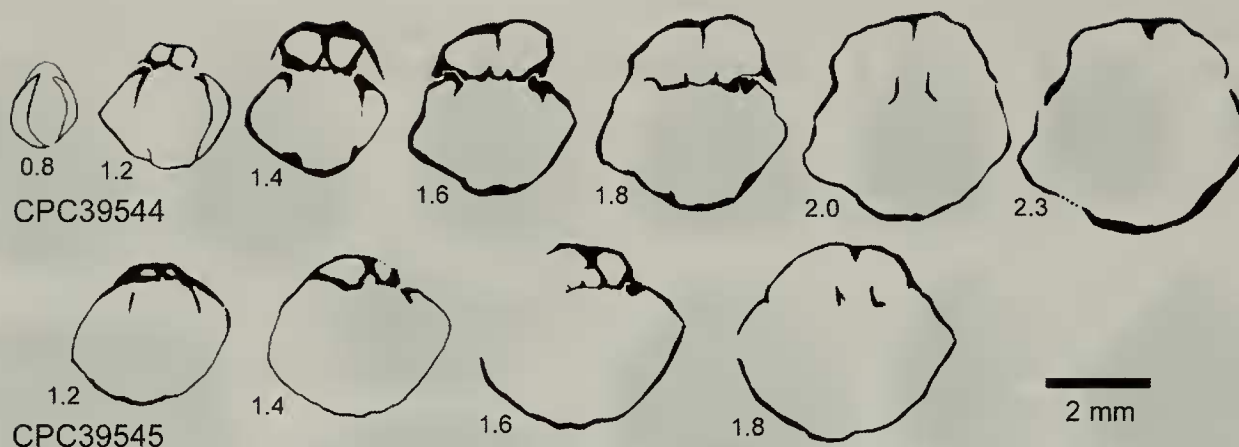


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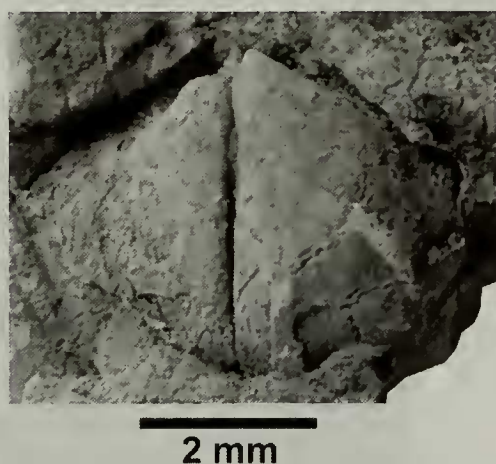


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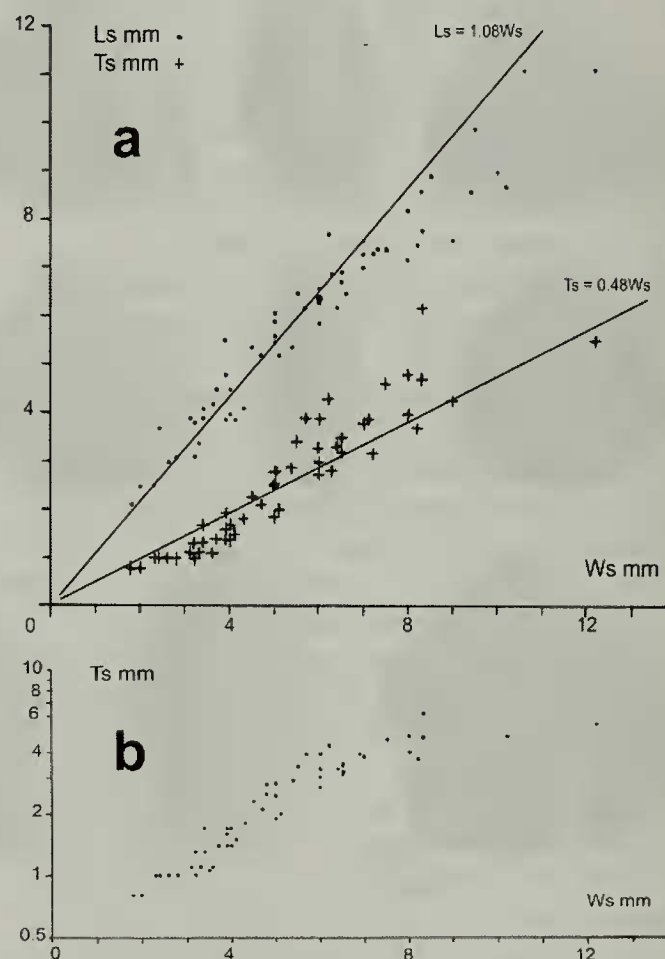


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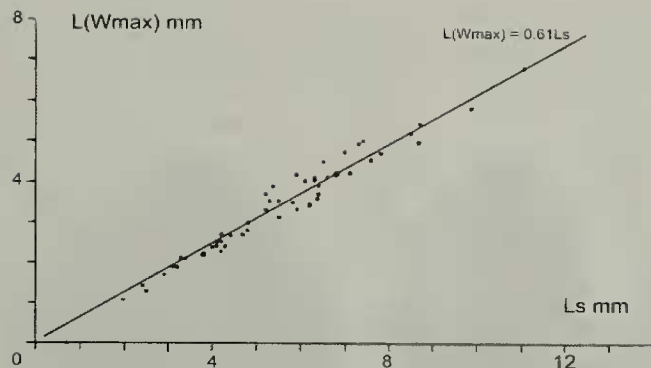


Figure 5. *Agarhyncha australe*; plot of length to greatest width (L(Wmax)) against length (Ls), showing only weak variability.

mm), more globose, with in some cases anteriorly truncated margins, often posteriorly elongate ventral beak, stronger ribs which may be flattened and grooved marginally, shallower sulcus, ribs at least faintly developed umbonally, high dorsal median septum, and rod-like crura. The Wenlock species *A. agason* Havlíček in Havlíček and Štorch, 1990 is of comparable size and outline, but has more and stronger, more angular ribs, especially medially. The other Bohemian Ludlow species, *A. chuchlensis* Havlíček in Havlíček and Štorch, 1990 is wider (Ls/Ws 0.83-0.95), with generally subpentagonal outline, low, rounded beak, weakly ribbed umbones, anteriorly well developed fold and sulcus, more ribs, ventral muscle field not impressed but dorsal adductor field with fine lateral bounding ridges, rod-like crura, and somewhat shorter dorsal median septum. None of the Bohemian species shows medially concave dental plates.

Family ORTHORHYNCHULIDAE Cooper, 1956
Genus *Tuvaerhynchus* Kulkov, 1985

Type species

Tuvaerhynchus khalfini Kul'kov in Kul'kov et al., 1985, by original designation; Wenlock, Tuva.

Diagnosis

Small with subpentagonal to subrectangular outline and dorsibiconvex profile. Beak suberect; delthyrium with disjunct deltidial plates. Fold and sulcus strong, narrow, well defined, from umbones; anterior commissure uniplicate; tongue high, trapezoid, dentate. Costae numerous, simple, angular. Dental plates short, vertical, close to valve wall. Septalium short, wide; hinge plates concave, slope medially; cardinal process septiform, thin; crura short, curved sharply ventrally (Savage p. 1081 in Savage et al. 2002).

Tuvaerhynchus? sp.

Fig. 6, Table 2

Material

Yass Formation: GOU47, CPC 39595 and 1 very uncertain fragment; GOU49, CPC 39596. *Barrandella* Shale Member, Silverdale Formation: GOU2a, CPC 39593. Lower Black Bog Shale: KF, ANU46537. Yarwood Siltstone Member, Black Bog Shale: GOU28, CPC 39594. Horizon uncertain: Bowning, "Upper Conglomerate", Mitchell Collection AMF28588, 133959 - presumably (following Mitchell 1887) from pebbles in the Sharpeningstone Conglomerate, derived from an older horizon.

Stratigraphic distribution

Yass Formation to Yarwood Siltstone Member, Black Bog Shale

Age

Late Wenlock? to early Ludfordian

Description

Available specimens are few, and mostly poorly preserved. Best are a steinkern from the Mitchell Collection, and a small shell from GOU47. Both are dorsibiconvex, with rounded outline; the small shell (CPC 39595, Ws 6.2 mm) is longer than wide (Ls/Ws ca 1.16), the steinkern (AMF28588, Ws ca 12 mm) transversely oval (Ls/Ws ca 0.8). They are globose - in both cases Ts/Ls is about 0.7. They are strongly ribbed, the ribs starting at the beaks. CPC 39595 has a shallow ventral sulcus with 3 ribs, there being 5 ribs on each flank. AMF28588 has a well developed fold and sulcus, forming a high trapezoidal tongue anteriorly; the sulcus contains 3 ribs, the flanks 5 ribs each, and the fold is formed of 2 ribs which split once. The other Mitchell Collection specimen, AMF133959, is an incomplete flattened internal mould with 4 ribs in the sulcus, 6 on each flank. Inter-rib furrows extend as short marginal spines. None of the specimens shows clear details of the ventral beak, and so the presence and nature of a delthyrium cannot be demonstrated.

Large teeth are supported by fairly short but distinct dental plates which are somewhat convergent towards the valve floor. Details of the ventral muscle field are not known. Dorsal median septum long, low, fine, continuous with linear cardinal process which arises from a shallow septalium which is either sessile or nearly so. Crural bases robust, crura unknown.

Discussion

Among Silurian rhynchonellides, the general

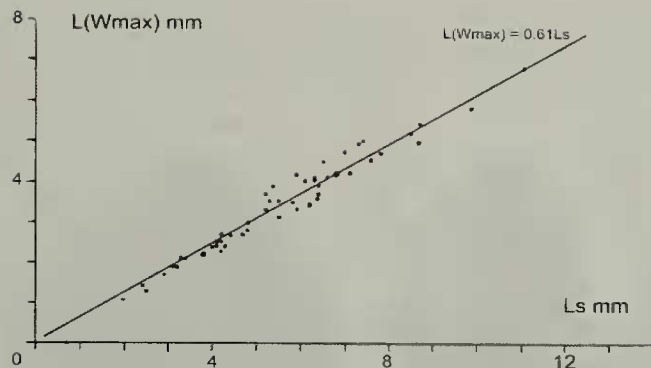


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Late Wenlock? to early Ludfordian

Description

Available specimens are few, and mostly poorly preserved. Best are a steinkern from the Mitchell Collection, and a small shell from GOU47. Both are dorsibiconvex, with rounded outline; the small shell (CPC 39595, Ws 6.2 mm) is longer than wide (Ls/Ws ca 1.16), the steinkern (AMF28588, Ws ca 12 mm) transversely oval (Ls/Ws ca 0.8). They are globose - in both cases Ts/Ls is about 0.7. They are strongly ribbed, the ribs starting at the beaks. CPC 39595 has a shallow ventral sulcus with 3 ribs, there being 5 ribs on each flank. AMF28588 has a well developed fold and sulcus, forming a high trapezoidal tongue anteriorly; the sulcus contains 3 ribs, the flanks 5 ribs each, and the fold is formed of 2 ribs which split once. The other Mitchell Collection specimen, AMF133959, is an incomplete flattened internal mould with 4 ribs in the sulcus, 6 on each flank. Inter-rib furrows extend as short marginal spines. None of the specimens shows clear details of the ventral beak, and so the presence and nature of a delthyrium cannot be demonstrated.

Large teeth are supported by fairly short but distinct dental plates which are somewhat convergent towards the valve floor. Details of the ventral muscle field are not known. Dorsal median septum long, low, fine, continuous with linear cardinal process which arises from a shallow septalium which is either sessile or nearly so. Crural bases robust, crura unknown.

Discussion

Among Silurian rhynchonellides, the general

SILURIAN BRACHIOPODS FROM YASS

	Ls	Ld	Ws	Ts	L(Wmax)	Ls/Ws	Ts/Ws
CPC39529*	6.2	5.6	6.4	3.3	3.4	0.97	0.52
CPC39530	5.9	5.5	6.0	3.9	3.3	0.98	0.65
CPC39534	9.0	-	8.9	5.0	5.2	1.01	0.56
CPC39538	5.9	5.4	5.0	2.5	4.0	1.18	0.50
CPC39543	9.9	-	9.6	-	5.5	1.03	-

Table 1: *Agarhyncha australe*: dimensions in mm and proportions of holotype (*) and selected para- types. Measurements in italics are best estimates for damaged specimens.

	Ls	Ws	Ts	L(Wmax)	Ls/Ws	Ts/Ws
AMF28588	9.7	12.0	7.0	4.8	0.81	0.58
CPC39593	10.5	9.5	5.3	5.5	1.11	0.56
CPC39595	7.2	6.2	5.1	4.0	1.16	0.82
ANU46537	7.5	8.0	-	5.5	0.94	-

Table 2. *Tuvaerhynchus*? sp.: dimensions in mm and proportions of selected specimens. Measurements in italics are best estimates for damaged specimens.

shell form and strong simple ribbing of this form, coupled with distinct but short dental plates and a linear cardinal process on a sessile or near-sessile septalium, points to the Orthorhynchulidae (whose genera are also united by possessing an open or near-open delthyrium). *Orthorhynchula* Hall and Clarke, 1893, has dental plates fused to the valve walls, and a low fold. The Tasmanian Ordovician *Tasmanella* Laurie, 1991, has a high fold, but differs in its fused dental plates, and a short, high dorsal median septum supporting a raised septalium. *Tuvaerhynchus* is closest morphologically, but in the absence of details of delthyrium, deltidial plates, and crura, generic identity cannot be certain. In the absence of that certainty, palaeobiogeographic speculation on this possible link between the *Tuvaella* and *Retziella* Faunas of Rong et al. (1995), and thus the Mongolo-Okhotsk and Sino-Australian Provinces of the Uralian-Cordilleran Region, is pointless.

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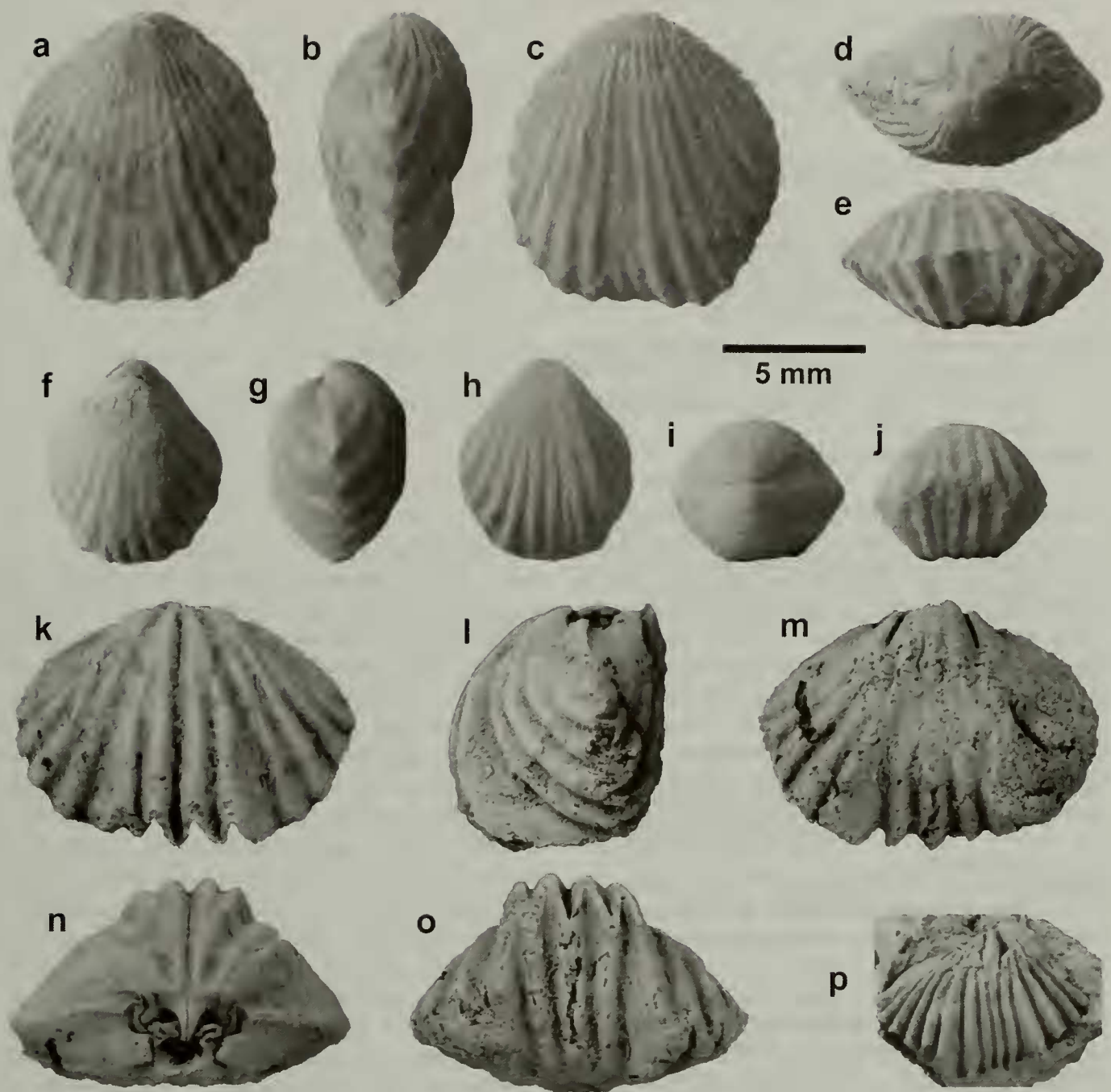


Figure 6. *Tuvaerhynchus?* sp.; a-e, CPC39593, a slightly crushed lenticular shell in dorsal, lateral, ventral, posterior and anterior aspects (locality GOU2a, Barrandella Shale Member, Silverdale Fm, late Gorstian); f-j, CPC39595, a shell in dorsal, lateral, ventral, posterior and anterior aspects, the dorsal umbo worn and revealing the median septum (locality GOU47, topmost O'Briens Creek Member, Yass Fm, probably Late Wenlock); k-o, AMF28588, a wide and very globose steinkern in dorsal, lateral, ventral, posterior and anterior aspects, the ventral beak broken (Mitchell Collection, from pebble in Sharp-eningstone Creek Conglomerate); p, AMF133959, somewhat crushed ventral internal mould (source as AMF28588). All $\times 4$, scale bar 5 mm.

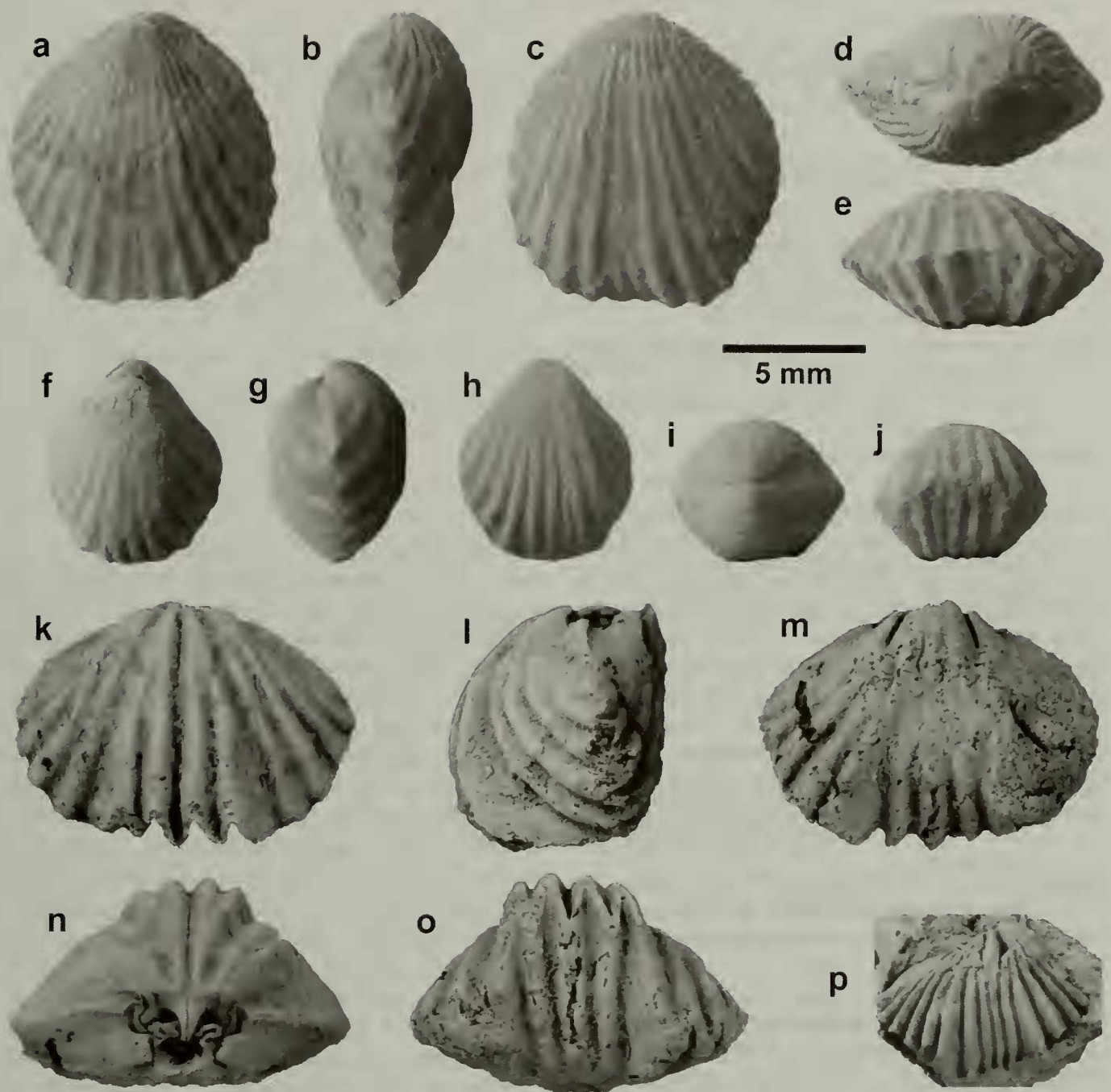


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